REMARKS/ARGUMENTS

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested. Claims 2, 4, 7-17, and 19-31 are pending, Claims 2, 4, 7, 8, and Claims 18-24 having been amended, and Claims 3, and 5-6 having been canceled without prejudice or disclaimer and Claims 30 and 31 added by way of the present amendment.

In the outstanding Office Action Claim 3 was objected to; Claim 2 was rejected under 35 U.S.C. § 112, second paragraph; Claims 2-7 and 18-29 were rejected as being anticipated by Stentz et al. (U.S. Patent No. 6,163,636); and Claims 8-17 were rejected as being unpatentable over Stentz.

In reply, the objection to Claim 3 is moot in view of Claim 3 being canceled.

Applicants traverse the rejection with regard to Claim 2, as Claim 2 does not recite that the second pump light has a predetermined amplification bandwidth that does not overlap with the bandwidth of the optical signal. It is believed that the Office Action is referring to Claim 3, which is now canceled.

Claim 2 has been amended to depend from Claim 8, and thus, the prior art rejection with regard to Claim 8 is now discussed. Claim 8 has been amended to define a Raman amplification method that includes, among other things, inputting from a signal input end of an optical fiber a second pump light having a shorter wavelength than the first pump light so as to Raman-amplify the first pump light, but not substantially amplify the optical signal. Furthermore, Claim 8 has been amended to include a step of inputting from the signal output end of the optical fiber a third pump light so as to Raman-amplify the first pump light, but not substantially amplify the optical signal. Claim 8, as amended, also defines the second pump light as propagating in the optical fiber in a direction that is substantially opposite to that of

the third pump light. Support for the amendment to Claim 8 is found in the present specification, for example Figure 7. Thus no new matter is added.

Moreover, Claim 8 is directed to a method in which an optical signal is Raman amplified by a first pump light. Second and third pump lights, each having a shorter wavelength than the first pump light, are included so as to Raman amplify the first pump light. The second and third pump lights propagate in substantially opposite directions in the optical fiber.

One advantage with this approach is that it allows the signal power to be substantially constant over an entire span of the transmission fiber. Another advantage is that it allows the lowest signal power over an entire span of the transmission fiber to be substantially constant over the signal bandwidth. This latter improvement corresponds to the improvement of the wavelength dependency of the lowest signal power or noise figure. Thus, the present invention allows the wavelength dependency of the lowest signal power over an entire span of the transmission fiber to be improved." And avoids an increase in noise figure at increased distance along the optical fiber (this phenomenon will be discussed in more detail with regard to Claim 25).

In contrast to amended Claim 8, Stentz does not disclose a method that inputs second and third pump lights that Raman-amplify a first pump light at a respective signal input end and signal output end of the optical fiber. Moreover, Stentz does not disclose co-propagating and counter-propagating pump lights, each of which is configured to Raman-amplify a first pump light, which in turn optically amplifies an optical signal. Rather, Stentz describes various embodiments where first and second order Raman pumps are used, but second order Raman pumps are not provided both a co-propagating and counter-propagating directions. As a consequence, Stentz does not offer the advantages that can be offered by the present invention, which allows for both gain flatness and noise figure flatness across the optical

signal's bandwidth. Consequently, it is respectfully submitted that Claim 8, as amended patentably defines over Stentz.

For substantially the same reasons and because Claims 2, 4, 7, and 9-16, all depend from Claim 8 it is respectfully submitted that these claims also patentably define over Stentz. Likewise, Claim 18 has been amended to define over Stentz. Since Claims 19-24 depend from Claim 18 it is respectfully submitted that these claims also patentably define over Stentz.

With regard to Claim 25 Applicants respectfully traverse the rejection. Claim 25 is directed to an optical transmission method that includes a step of controlling a wavelength dependency of a system noise figure by selecting a central wavelength of the second pump light to be a predetermined wavelength. The outstanding Office Action asserts that Stentz discloses all the features of Claim 25, however Applicants respectfully disagree. The outstanding Office Action asserts that Stentz discloses the controlling step, citing column 4, lines 46-54 of Stentz. However, this portion of Stentz is directed to distribution of power within each of the pumps to be shaped in order to generate a broad and flat signal gain as illustrated in Figure 6 thereof.

However, achieving gain flatness does not give rise to noise figure flatness. It is the minimum signal power along the longitudinal direction of an optical fiber that affects noise figure flatness. One of the reasons for not obtaining noise figure flatness is that the longer wavelengths of the pumping light are maintained along the longitudinal direction of the optical fiber due to the Raman amplification among the pump lights. In order to illustrate this point, please refer to Figures 1-3 attached to this paper.

As seen in Figure 1, a graph of signal power versus wavelength is shown for two situations. The first situation is the wavelength dependence of signal at a signal output end, which is seen to be flat across the optical signal's bandwidth. However, the wavelength

dependence of the lowest signal power over the entire span of the transmission fiber (which relates to noise figure) is shown to be sloped, having a lower signal power at shorter wavelengths and higher signal power at longer wavelengths. The non-flat noise figure for the system is set by the lowest signal power over the entire span. Thus by Stentz merely controlling the output signal power, Stentz does not provide a system by which noise figure can be controlled. In contrast, as is achievable by the present invention, both that wavelength dependence of the signal at the signal output end may be controlled to be flat as well as the lowest signal power over the entire span of the transmission fiber can be made to be flat. In this way, the flat lowest signal power is what sets the noise figure, and thus the wavelength dependence of a system like that in Stentz can be cured by a system like that of the invention defined by Claim 25.

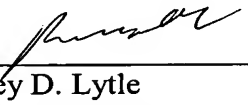
Fig.3 shows signal powers as a function of distance along the optical fiber. Two thin lines show shorter signal wavelength. Two thick lines show longer signal wavelength. Upper 2 lines show the effect of this invention which is the method of having a step of co- and counter propagating pumping and lower 2 line show prior arts which is the method of one way propagating pumping. As the large vertical arrows shown in Fig. 3, noise figures improve in both shorter and longer signal wavelengths by using co- and counter propagating pumps instead of one way propagating pump.

Thus, it is respectfully submitted that there is not a correspondence directly between a flat gain and a flat noise figure. It is respectfully submitted that the system in Stentz would not necessarily provide a flat noise figure as asserted in the outstanding Office Action. However, the invention identified by the present inventors, would be able to provide both gain and noise figure flatness control. As Stentz neither teaches nor suggests this feature of Claim 25, it is respectfully submitted that Claim 25, as well as dependent Claims 26-31 also patentably define over Stentz.

Consequently, in view of the present amendment and in light of the foregoing comments, it is respectfully submitted that Claims 2, 4, and 7-31, as amended patentably define over the asserted prior art. The present application is therefore believed to be in condition for formal allowance and an early and favorable reconsideration of this application is therefore requested.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



Bradley D. Lytle
Attorney of Record
Registration No. 40,073

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 06/04)
BDL:smi
I:\ATTY\BDL\239948US-8CONT\239948US-AM 11-05-04.DOC